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bird at least had been compelled to lay her eggs, and then must leave them behind. And this pretty treasure on my table is one of them. Interesting, was it said? Nay, is it not historic, a memento of this remarkable exodus of the night herons from their almost romantic heronry at Three-mile Run, New Jersey. Do you ask, "Did they hold together as in a well-ordered retreat? And did they establish a heronry elsewhere? Or did the dispirited community dissolve itself into the isolation of single pairs? And finally, where did they go?" Well, just these are the questions which we are aching to find out. Meanwhile, let this much go on the record, of the time, circumstance, and spirit of the exodus of this ancient colony of birds.

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VARIATIONS IN THE NESTS OF THE SAME SPECIES OF BIRDS.

BY DR. T. M. BREWER.

IN the present brief paper I propose to deal more with facts than with theories. I leave to others to make such deductions therefrom as may suggest themselves. When one cannot, to his own satisfaction, point out the reasons that can fully account for indisputable facts, it seems to be the safer course to be content with only taking cognizance of natural phenomena, just as they impress our senses. The legitimate scope of the naturalist is first correctly to describe isolated facts as they present themselves. To seek to investigate the laws that unite these, though always tempting, is not always safe. The homely advice: "Never to prophesy unless you know," is applicable to the case. There is no worse bondage to the student of nature than to be a slave to theory. The danger of a "little learning" is of its leading to unwarrantable deductions, and then the temptation to color facts to suit preconceived opinions may become one of the besetting weaknesses of our human nature, against which it behooves naturalists especially to struggle manfully.

From time immemorial the theory has been prevalent, and generally accepted, that the constructions of all animals, man excepted, are the inevitable results of a faculty called instinct. On the other hand it is claimed that all the constructions made by man are due to another faculty known as reason. To this I am not prepared to assent without many qualifications. Thus broadly stated it is entirely inconsistent with innumerable facts. The architectural achievements of very many kinds of birds, their variations and their deviations, their skill, their wonderful adaptations to varying circumstances, all point to intellectual action much higher than a mere blind instinct. The wretched holes, the degraded lives, on the other hand, of the Papuans and the Australians are surely not evidences of reason, properly so called. Their homes are infinitely below those of nearly all the feathered tribes, and show no advance. A few years ago it was discovered by accident that within fifty years there has been a wonderful change in the manner in which the common house martin of Europe builds its nest. Formerly their nests were globular in shape, with a small rounded opening, hardly large enough to admit the parent birds comfortably. Such are all the old nests in museums, such the descriptions of all writers, half a century ago. These nests were inconvenient, only one bird could come at a time to the opening to be fed. Long before the young could leave their nest, they must have been uncomfortably crowded in their ill-ventilated and close quarters. Some time within the half century this entire species has made a great advance and wonderful changes in the whole style of their nest. Instead of a sphere, the nest is simply hollow, semi-oval, roomy, airy and comfortable, stronger in its attachments, with increased facilities for access, better protected, both from the rain and from enemies. Unfortunately no one observed just when this remarkable change in their architecture took place. We know not if it was gradual or sudden, or how long it was in becoming general. But surely no one can pretend that all this was the result of mere instinct! Wallace maintains that no bird can succeed in constructing a nest in the same manner as its congeners, if it has not first learned their method, either from its own parents or from others of its kind. From this it would appear that birds brought up in confinement, from their nests, cannot construct nests like those of their fellows who have always been at liberty. Without attempting to decide how far Wallace's theory may be well founded, I can give two instances that have fallen under my own observation, that have an indirect bearing on the general need of instruction in other things than making a nest. A young cedar bird fell from its nest and was so severely injured that it never obtained the use of one wing. It was fed from the hand and remained wholly dependent on the care of its benefactor. It never would attempt to feed itself even with food all about it, and when it was transferred to other hands died of starvation in the midst of abundance. Nearly the same occurred with a young mocking bird, who always insisted upon having its food held to its mouth. The latter died young, but the cedar bird reached maturity, and was two years old without learning to feed itself.

It is contended by some naturalists that the nests of young birds are invariably poorly made and not well situated. This, however, is a belief that it would not be very easy to verify. That birds of the same species do not always build their nests alike, that under varying circumstances they will vary their style in a very remarkable manner, is a matter of not unfrequent observation. Thus the cliff swallow, in wild tracts of country, and in its original haunts, constructs, with much labor, a long nest, shaped like an inverted retort, with the entrance from below. On Green Island, one of the Grand Menan group, I saw a large colony availing themselves of two boards put up for their convenience, and about half a foot apart, under the eaves of a barn, and all building open cup-shaped nests as unlike their typical nests as can be conceived.

In the last number of the Nuttall Bulletin, Mr. Brewster contributes a very interesting paper on the nesting of the yellow-throated warbler, *Dendrœca dominica.* The nest found by Mr. Brewster was on a stout horizontal branch of a southern pine, set flatly on the limb. It was a well made—an unusually well made nest, the framework being a few twigs and strips of bark into which had been worked a beautiful soft felting of moss and silky down of plants, all neatly and firmly compacted. I have seen the nest and am inclined to the opinion that it is probably the typical style of this bird, whenever it builds in a region where the abundance of the Spanish moss does not tempt it to make use of that growth, and there to build a totally different nest, with no other framework than the long fibres of the moss afford. In the appendix of the Ornithology of North America, I refer to several nests of this bird built in this latter manner, taken by Mr. Norwood C. Giles, of Wilmington, N. C. Several of these nests were obtained and well identified, and sent with their parents to the Smithsonian. Unaware of this positive identification, Mr. Brewster very naturally infers that Mr. Giles must have been mistaken. But this was not so. His identification was complete, and only adds another remarkable instance of variation in the mode of nest building by the same species. The history of several of our North American birds also affords abundant evidence that it is by no means safe to assume that the same species may not exhibit a "great difference in the position and structure of the nest," under varying circumstances.

The recent observations of Dr. James C. Merrill (MSS.) shows that the *Icterus cucullatus* displays quite as striking variations as this warbler. Some of its nests, like those of the latter, are buried in tangled and elaborately interwoven masses of the Spanish moss, and have no apparent resemblance to others built in the more normal pensile style of its congeners, such as the orchard oriole and others. So, too, with the nests of the *Empidonax acadicus.* The first identified nest of this species I ever saw was a flat platform, so common in *Contopus borealis*; and this is its usual style about Philadelphia. The second was a deep cup-like nest, surrounded and surmounted by a curious chevaux-de-frise, somewhat in the style of the magpie and the mocking-bird. This style is common in Indiana. And now within a few months, I have received two other nests equally well identified, one of them with the eggs, the nests being pensile and not unlike those of the orioles. Such facts as these warn us that we need not and should not, on too slight grounds, discredit either the carefulness or the truthfulness of our fellow-workers in observing the hidden and often varying facts of natural history, even when their observations do not accord with our own. The account of the nesting of the *D. dominica* given by Mr. Nuttall has always seemed in the last degree improbable, and to be in conflict with that of Mr. Audubon, and their discrepancy has long been a stumbling-block to students until more light began to be thrown upon its history. Mr. Giles' revelations gave us some clue to what seemed the fabulous narrative of Mr. Nuttall. For when we remember how closely together stand the trees in a cypress swamp, how the long "ropes" of *Tillandsia* do swing from tree to tree, we can now understand how Mr. Nuttall, having never seen it himself, may have imperfectly understood the information he received from another in his account of its swinging nest. And now Mr. Brewster confirms substantially Mr. Audubon's discredited account of his experiences. After all, these pioneers in American ornithology may not have been so absurdly inconsistent, or so entirely at fault as we, in our own ignorance, have taken for granted.

I might go on and prolong this article by other accounts of conspicuous variations made by the same species in its nest-building, citing the lammergeyer that builds indifferently a huge nest on a tall tree, or lays its eggs on the bare ground or some tall cliff, without any nest at all, but I have given enough to show how marked these variations often are. To speculate on the whys and the wherefores would be a very tempting theme were it not that we are so often at fault in attempting to explain them. But I do not believe it is logical to call the intellectual promptings that inspire these variations mere instinct, though we may not be able to read clearly the hidden motives. If experience taught the European martin that its old-fashioned nest, which perchance it had built since the flood, was inconvenient, ill-ventilated and unsafe, and they were prompted by the example of some wiser intellect among themselves to improve upon the hovels of their fathers, so that all at once the whole race made a long stride in improvement, can we call this instinct? Grant that the changes have been slow—extending over fifty years—so gradual that no one has noticed the change while it was going on, we cannot deny the advance, and advance is inconsistent with our ideas of instinct which is unchangeable and incapable of education. It is a clear case of reason and instruction, yielding marked fruits, and is on a higher plane. That birds like the *Dendrœca dominica* and the *Icterus cucullatus* build a typical nest, like their congeners, where nothing tempts them to do differently, but where the long branches of *Tillandsia* offer a safe shelter and the absence of labor, shows something higher than instinct, there must be a rational intellect that prompts them to avail themselves of the opportunity.

If we cannot understand what it can be that stimulates an *Empidonax* in Staten Island to build a pensile nest, while its fellow in Indiana builds one like a deep cup and surrounded with thorns, and another group in Pennsylvania put theirs on an exposed tree-top, and so flat that the eggs seem liable to roll out, we must see that some cause, hidden to us, is gradually effecting changes that sooner or later may become universal in the species, though which it is to be we may not be able to imagine.

Our eastern song-sparrow's natural instinct prompts it to build on the ground. A series of disasters to its eggs or brood impress it with the need of a safer place. It draws nearer the friendly shelter of a dwelling, and there, no longer on the ground, but up in some thick bush or vine, it makes its nest. For want of the tufts of grass or weeds that furnished it with a roof, it changes its whole shape and builds a bulky, nearly spherical, domed nest. Some of its offspring adopt the new style of their parents, but others fall back upon their original style. The latter may be considered the promptings of a natural innate instinct, but the domed nests, the changes initiated by the parents and imitated by the more enterprising of their offspring are due to a higher intellectual power that rejects the blind suggestions of their original instinct, and teaches them to follow the paths of experience to safety. This is no imaginary case, but rests on facts within my own observation.

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THE RELATION OF ANIMAL MOTION TO ANIMAL EVOLUTION.

BY E. D. COPE.*

THE origin of variation in animal structure is, *par excellence*, the object of the doctrine of evolution to explain. There can be little doubt that the law of natural selection includes the cause of the preservation of certain modifications of preëxistent structure, in preference to others, after they have been brought into existence. In what manner or by what process the growing tissues of young animals have been so affected as to produce some organ or part of an organ which the parent did or does not possess, must be explained by a different set of laws. These have been termed *originative*, while those involved in natural selection are *restrictive* only.

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Of course we naturally look to something in the "surrounding circumstances" in which a plant or animal is placed, or its "environment," as the most probable stimulant of change of its character, because we know that such beings are totally dependent on cosmic and terrestrial forces for their sustenance and preservation. The difficulty has been to connect these forces with change of structure as *originative* ; to show their operation as multiplying, restricting or destroying organisms already in existence is comparatively easy. This difficulty is partially due

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